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ABSTRACT

This monograph presents an updating of a report made in 1969 which led to the development of the Del Mod System. It is an assessment of science education in Delaware. Data presented were collected on site in the schools. Assessment of the science facilities, curriculum, and attitudes was made. Science programs in use in 1974 in the elementary, middle, and senior high schools are described. Total program of offerings in the various grades is presented. A comparison of the type of facility in which secondary science classes are conducted is presented. The report is compiled from data collected in terms of numbers of students, science programs, and percentage of participation and translated by means of tables, graphs, and in narrative form. (EB)

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THE STATUS OF SCIENCE TEACHING IN DELAWARE

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FORWARD

The Status of Science Teaching in Delaware 1974 is an updating of the Purnell report of 1969 which was one of the documents which led to the creation and direction of the Del Mod System. The 1974 document is an assessment of science education in Delaware as Del Mod passes the midpoint of its existence.

There are some interesting contrasts between the two documents not only in what is reported, but in the manner of the data collection. In the pages following the presentation of 1974 findings, some of the contrasts in data are highlighted.

The data collection for the 1974 report differs from that of 1969 in an important aspect: All of the data was collected on site in the schools rather than by the use of questionnaires. Dr. Ruth Cornell, Supervisor Emerita, Wilmington Public Schools, Mrs. Audrey Conaway, a Del Mod field agent, and John F. Reiher, State Supervisor of Science & Environmental Education, visited the schools and met with the staffs of those schools to make an assessment of the science facilities, curriculum and attitudes therein.

The observations of Cornell and Conaway were formalized by a check list designed by John Bolig, Del Mod research director, and Charlotte Purnell, Del Mod Director, and the observations were amended with written subjective comments when this seem appropriate. For example, in several elementary schools which claim to be SAPA-oriented (Science A Process Approach), and which have SAPA science kits in the classrooms, Mrs. Conaway noted that, despite these science kits, the teachers were not SAPA-oriented. This type of comment had a great impact on Del Mod field agent activities.

The reader is urged to compare 1961, 1969 and 1974 reports which are very similar in their format and in their tabular presentation.

The report herein is referred to as the "Cornell Report" or the "Cornell-Conaway Report" in various Del Mod documents. It has been an invaluable survey. The State Director of the Del Mod System, the Research Director and the State Supervisor of Science & Environmental Education are very grateful to Dr. Cornell and Mrs. Conaway for the work they have done.

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PROCEDURE

During the schoo! years 1971 - 1972 and 1972 - 1973 a survey of the science programs in the public schools of Delaware was conducted by the Del Mod System in cooperation with the Department of Public Instruction. This was made by means of visits to schools and interviews with principals and teachers. all of the public secondary schools in Delaware and over 70 percent of the elementary schools were visited and reports compiled. Forms were used to collect the information so comparable data are available.

Principals and some teachers were interviewed in the elementary grades. In the middle schools interviews were conducted with principals and some teachers and visits were made to science rooms for the purpose of observng the available facilities and the uses made of these. In the senior high schools interviews were held with administrative staff personnel and conferences were arranged with individual teachers or groups of teachers in departmental meetings. Some interviews and meetings were held during the school day and others as after-school activities.

Tne goals and services of the Del Mod System were discussed at the teacher conferences. Teachers were encouraged to participate in planned programs and to suggest new programs to be supported by the Del Mod System.

This report is compiled from data collected in terms of numbers of students, science programs, and percentage of participation and translated by means of tables, graphs, and in narrative form.

SCIENCE TEACHING PRACTICES IN DELAWARE

ORGANIZATION

The type of organization of the public schools in Delaware is a function of the individual districts and the differences in grades included in each school within the district is explained in the elementary, middle school, and the senior high school reports. All reports must be studied to obtain a true picture of programs and enrollment especially in grades 5, 6, and 9.

ELEMENTARY SCHOOLS (GRADES K-6)

DISTRIBUTION OF GRADES

There were 119 elementary schools in Delaware in 1972 - 1973. The grades included in these schools varied accordingly to the district organization. The variance of grades included and the percentage of schools in each group was:

Grades	Percentage of Schools
K - 4	24%
K - 5	24%
K - 6	20%
Others	32%

The distribution of grades included in the last figure varied from one to five grades. Thus the program totals vary greatly as noted in Table 1. Grades 5 and 6 were included in 62 per cent of the elementary schools. These same grades in other districts were included in the middle school organization in which 24 schools or 55 per cent included grades 5 and 6. Since there was an overlapping of these grades, for the purpose of this report grades 5 and 6 are reported within the school structure in which they are housed.

OFFERINGS

In the elementary grades the predominant science program was SAPA, closely followed by the Harper & Row series, *Today's Basic Science*. Some schools reported a multi-text approach and many utilized district or individual-teacher prepared or planned units. There was no specific program in some schools and what science was taught was at the discretion of the teacher as to topics and scheduling.

There were three nationally developed programs in use: SAPA, ESS, and SCIS. Four different texts had been selected to be used in most or all grades in a specific school or district.

Science was not taught as a separate subject in many schools nor in all grades within a school. Random science teaching was reported in some cases and this term seemed to apply to many schools especially in the primary grades. (See Table 1).

TABLE 1

SCIENCE PROGRAMS IN USE IN DELAWARE ELEMENTARY SCHOOLS

Program	Grade K	1	2	3	4	5	6
ESS		1	1	1			
SCIS					1	1	1
SAPA-AAAS	27	43	40	37	21	10	9
Harcourt, Brace & J	5	6	5	7	9	9	1
Harper & Row	7	7	8	9	12	10	
D. C. Heath			1	2	2		
McGraw Hill		1	2	2			
District Program	1	2	2	4	11	12	9
Multi-text	4	6	5	6	8	4	
Teacher Units	1		1	2	4	2	2
No Specific Program	16	5	5	3	4	4	4

Number of Schools Using Program

(SCIS, Science Curriculum Improvement Study; ESS, Elementary Science Study; SAPA, Science a Process Approach)

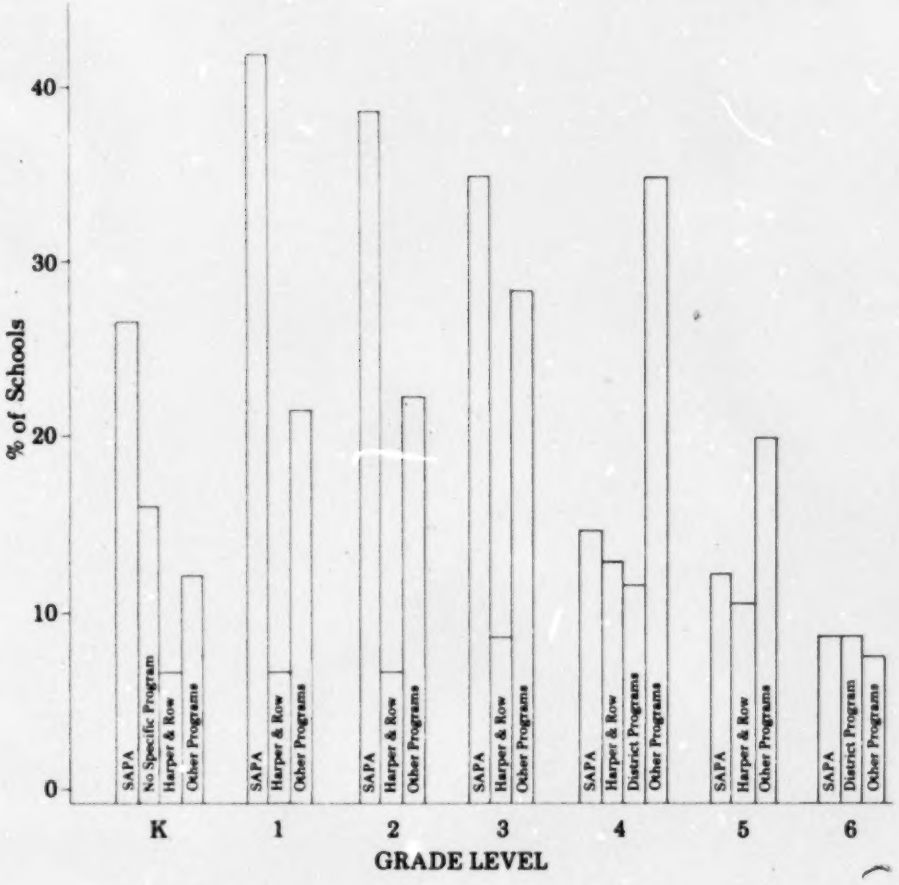
PROGRAM

In the primary grades science instruction did not appear to be a regular part of the school day as 55 per cent of the schools reported that science was taught only one or two periods weekly. In the upper grades (4, 5, and 6) science was taught daily in 42 per cent of the schools reporting. In all grades 30 per cent of the schools reported that science was not scheduled and was taught at the discretion of the teachers. Sixty per cent of the schools reported no departmentalization at any level, while 8 per cent reported departmentalization of the primary grades and 33 per cent reported that all or some of the upper grades were departmentalized. (See Table 2).

The program and/or the textbook selection was decided by different groups in the districts. The largest group concerned was the teachers in 42 per cent of the schools while the district committees decided the program in 27 per cent, supervisors in 22 per cent and the principals in 9 per cent.

TABLE II

PROGRAMS USED IN ELEMENTARY SCHOOLS



Environmental education was taught, sometimes in specific units and in others at random, in 77 per cent of the schools. Field trips, one or many, were scheduled by 88 per cent of the schools.

In the primary grades the SAPA program had been adopted by a majority of schools. In the upper grades SAPA was not used so extensively and the adoption of a text series accounted for approximately 50 per cent of the offerings. No definite program in any grade, or a different program or text in each grade, was reported by 22 per cent of the schools.

Some teachers were dissatisfied with the SAPA program because it is too structured. There is also a material problem, and it needs excessive planning time. Some principals were very pleased with the program. Because of the dissatisfaction with the program some teachers were considering adopting teacher constructed units to replace SAPA. The work of the Del Mod Field

Agent was cited as being very helpful to teachers to understand the nationally developed programs and to help in implementing these in the classroom.

In-service training seemed to be lacking in most schools as 50 per cent of the principals reported no in-service available to teachers in their district except through the Del Mod System.

Equipment for science instruction in elementary schools was reported as adequate by most. In adopting a national program sufficient kits were purchased at the time of the adoption. However, the presence of the kits did not guarantee their use. Teachers reported that the kits needed refurbishing and replenishing. Expendables in the kits had not been replaced. Poor or inadequate equipment was reported by 18 per cent of the principals. Types of equipment available to science teachers included microscopes, incubators, cages, aquaria, terraria, rock collections, kits, etc.

The storage of equipment was in the classroom in 60 per cent of the schools and many teachers found this unsatisfactory as not enough storage space was available.

There was no special budget in 50 per cent of the schools. In some cases the district set the budget for science and in others (40 per cent) the teachers in the local buildings requested allocations for materials from the principal and the decision to purchase was made at this level.

Some schools were using films, filmstrips, and displays in the teaching of science. Most teachers "perform" and there is very little child participation. The principals report that in many cases the children just sit in science classes. Many elementary teachers have no commitment to science. They feel they are not scientists and therefore not capable of teaching science. The newer teachers are trying the nationally developed programs of science with varying degrees of success. The philosophy of science education has never been adopted by many teachers.

MIDDLE SCHOOLS (GRADES 5 - 9)

GRADE DISTRIBUTION

The reorganization of the former junior high schools in Delaware has resulted in a variety of grade allocations and titles of schools. The range of grades is from 5 - 9 inclusive and there is an overlapping with the elementary and senior high schools. Various combinations are found throughout the districts as grades 5 - 6 (1), 5 - 8 (10), 6 - 7 (12), 6 - 9 (1), 7 - 8 (7), and 7 - 9 (12). Each year some changes are made so these figures are not static.

The names of these schools vary as junior high school, middle school, and intermediate school. Three are disignated as "name" schools with no grades indicated, three are housed with the senior high school in the district, and three schools are ungraded. The terminology "middle" school will be used in this report for grades 5 - 9.

The number of schools including grades 6 - 8 and 7 - 9 are the largest groups with 30 per cent each. As indicated in the elementary school report 55 per cent of the middle schools includes grades 5 and 6, while 62 per cent of the elementary schools include these same grades. The similarities and differences of the programs in grades 5 and 6 in the elementary and middle schools are indicated in Tables I and III.

The programs and percentage of participation in science for grades 5 and 6 in the middle schools are shown in Table III. The ungraded schools offer a program of a three year cycle in science with all the grades enrolled in one third of the cycle in each school year. This is indicated in Table III as ungraded with no science areas designated.

COURSE OFFERINGS

In the middle school in Grade 5 life science was offered in 30 per cent of the schools, SCIS in 16 per cent, development of skills in 15 per cent, and general science in 14 per cent. For the program for years 5 and 6 in the elementary building housing those grades, refer to the elementary study and Table I.

The predominant science program taught in grade 6 in the middle school was physical science with 22 per cent of the schools offering such a program, 21 per cent emphasizing skills development, 16 per cent giving a general science, 13 per cent adopting the SCIS program, and 18 per cent listing the school as ungraded.

In grade 7 life science was scheduled for 80 per cent of the students with no other separate offerings for more than 1 to 7 per cent each. The ungraded group for this grade was 6 per cent. (See Table III).

Earth science was offered to 60 per cent of the eighth grade students while ESCP (Earth Science Curriculum Project) was scheduled for 12 per cent. The ungraded group was 6 per cent for this grade. (See Table III).

TABLE III

EXTENT OF PARTICIPATION AND PROGRAM OFFERINGS IN GRADES 5-8

Grade	*Program*	*No. Enrolled In Grade*	*No. Enrolled In Program*	*Percentage of Participation In Each Program*	*Total Percentage of Participation in All Science Programs*
5	Life Science	2191	658	30%	100%
	SCIS		361	16%	
	Skills		330	15%	
	General Science		304	14%	
	Other Programs		238	11%	
	Ungraded		300	14%	
6	Physical Science	5306	1193	22%	100%
	Skills		1095	21%	
	General Science		827	16%	
	SCIS		696	13%	
	Life Science		226	4%	
	Other Programs		321	6%	
	Ungraded		948	18%	
7	Life Science	10382	8344	80%	100%
	IMB		753	7%	
	ISCS		276	3%	
	Skills		282	3%	
	Earth Science		129	1%	
	Ungraded		598	6%	

TABLE III, cont.

8	Earth Science		6052	60%	
	ESCP		1263	12%	
	Physical Science		936	9%	
	IME	10243	306	3%	100%
	ISCS		126	1%	
	Earth and Physical		125	1%	
	General Science		139	1%	
	Special Units		427	4%	
	Skills		303	3%	
	Ungraded		566	6%	

TABLE IV

EXTENT OF PARTICIPATION AND PROGRAM OFFERINGS IN GRADE 9 IN MIDDLE SCHOOLS

Grade	*Program*	*No. Enrolled In Grade*	*No. Enrolled In Program*	*Percentage of Participation In Each Program*	*Total Percentage Of Participation In All Science Programs*
9	Physical Science		1085	36%	
	IPS		977	32%	
	Biology	3013	164	5%	78%
	ISCS		124	4%	
	BSCS (Yellow)		287	10%	

(See Table V for combined enrollments in grade 9 in middle schools and senior high schools).

The ninth grade was included in 30 per cent of the middle schools and in 70 per cent of the senior high schools. This represents approximately 30 per cent of the total ninth grade enrollment as housed in the middle schools and 70 per cent in the senior high schools. In the middle school organization (in the schools including ninth grade) science is elective in 50 per cent of the schools. The ninth grade offerings in the middle school indicated physical science at 36 per cent, IPS 32 per cent, BSCS (Yellow) 10 per cent, and the other offerings at 9 per cent. (See Table IV).

The total percentage of participation in grades 5 - 8 was 100 per cent and in grade 9 was 78 per cent. The total participation in science in the middle schools was 96 per cent of enrollment.

STRUCTURE AND TECHNIQUES

There were 188 full-time science teachers in the middle schools and an additional 40 persons teaching science part time, thus 80 per cent were teaching full time.

Most teachers taught five classes daily. The average class size was above 25 pupils in 72 per cent of the schools. Ability grouping was reported in 60 per cent of the schools, but this was mostly in the highest and lowest levels. There were a few schools where some individual scheduling was arranged.

Teacher techniques covered the entire spectrum of instructional methods. In each school there appeared to be a variety of techniques in use by individual teachers. The principals reported that some teachers used activities, laboratory work, and inquiry methods but all do not fit the "pattern". The district curricular offerings using a multi-text approach, the work of the Del Mod Field Agents, and the adoption of the nationally prepared programs are having a great effect on changing the techniques in use in the middle schools.

PROGRAM

As reported by the principals the program or text is selected by the teacher. Many schools use the curriculum developed by the district committee or by the teachers in an individual school. The areas selected for use in the different grades seems to be at the discretion of the teachers or is influenced by the textbooks already in use in the building. In some cases one teacher appears to make the decision for the department as to sequence of subject areas or adoption of national programs. Some of the national programs adopted were SCIS, IMB, IME, ESCP, and ISCS. (See Table V). Several schools reported a program based on the development of skills for the overall program and each teacher selected the material for implementing those skills in the classroom.

Where the schools were ungraded the same subject area was used for all grades each year with a two- or three-year sequence planned. Thus all grades may study earth science one year, life science the next, and so forth.

Most teachers report a multi-text approach that some development of skills and concepts throughout the middle school curriculum was shown in the programs developed by the teachers within the district.

Mini-courses are offered by 20 per cent of the schools. These may be three, four, six, or nine weeks in duration. The subject matter, the mechanics of administration, the time allotment, and the student choice differ so greatly there is no common denominator for mini-courses in Delaware.

In 19 per cent of the schools the principals reported there are no funds available for field trips or the teachers are not willing to take the children out of the building but most schools have one field trip per grade during the year. Many teachers use local parks, woods, ponds, etc., for study and collection and some schools journeyed to the sand dunes to plant grass on them and this was the major trip of the year.

Most schools report that environmental education is included in the science units. In 23 per cent of the schools, mini-courses or clubs have environmental education as the major emphasis. In these cases the student choose the offering so all students do not receive this type of instruction.

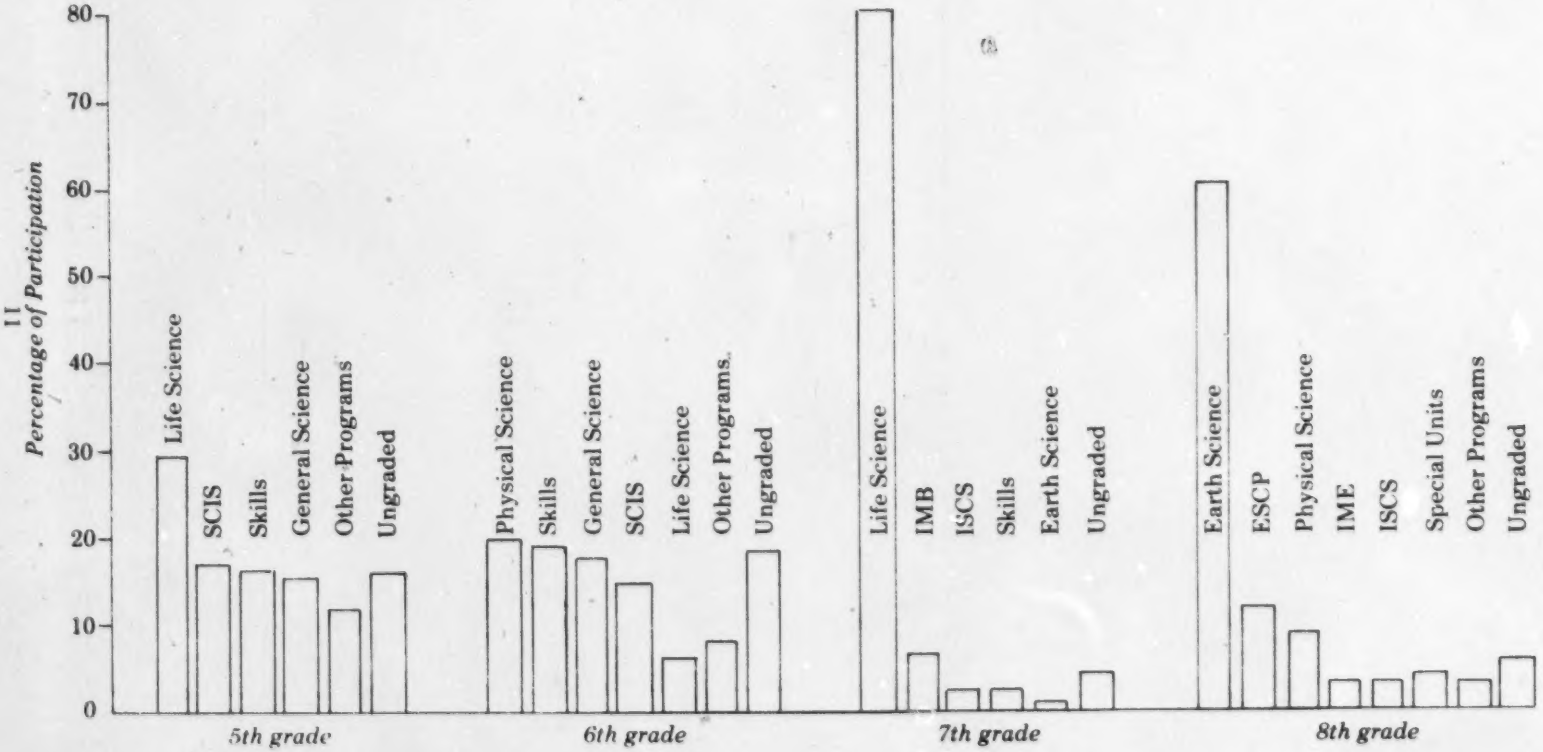
FACILITIES

Some of the middle schools are new and have planned for the grades housed there and the facilities are adequate. Others are old senior high school buildings used by the middle school because of redistricting in Delaware and the subsequent building of new senior high schools. Most of the new facilities are wall-assembly type with movable furniture and good storage areas adapted to the needs of this age group.

Four of the schools have greenhouses and five have planetaria. There are three other schools where it is planned to install a planetarium within the next three years. Other districts have a planetarium in the senior high school building which facility may be scheduled for use by the middle school students.

TABLE V

PROGRAM OFFERINGS IN GRADES 5 - 8



Where the housing is in the old senior high building, some remodeling has been accomplished and is fair to good, but most of the laboratory layouts are not functional for the teaching of middle school science.

Converted classrooms and regular classrooms in use for science teaching each account for 12 per cent of the installations in the buildings. Some type of laboratory facility is available in 65 per cent of the schools but some of these facilities are not functional nor are they in use.

In some cases the equipment is more than adequate but many schools do not have enough specific pieces for individual student use and thus teacher demonstrations are the rule. Project work is carried out in many classes and the results of this are shown in the display cases and, more to the point, in the classrooms. The ingenuity of teachers and pupils provides inexpensive materials for enlarging the activity program.

EXPENDITURES

The principals say the teachers request the materials they wish and that they have adequate supplies. In fact, in most cases, they claim that there are sufficient supplies and all teacher needs are met. This is more in evidence where a national program has been adopted and a "package" was purchased.

The teachers do request materials and supplies but must trim orders to fit the budget and must justify the need for these materials. The teachers may request by priority but in most cases the principal has the final check.

The principal sets the departmental budget in 30 per cent of the schools and the district sets a per pupil allotment for science materials in 10 per cent of the schools.

There is a fixed budget in 19 per cent of the schools and the teachers must work within the same budget each year, but in many cases the principal assigns a different allotment each year, balancing allotments between departments in different years. This is the practice in 81 per cent of the schools. Petty cash is available to science teachers in 87 per cent of the schools.

SENIOR HIGH SCHOOLS (GRADES 9-12)

COURSE OFFERINGS

As stated in the report of the middle schools 70 per cent of the total ninth grade enrollment was housed in the senior high school buildings. Science is elective in the ninth grade in 52 per cent of the senior high schools and 50 per cent of the middle schools in Delaware. For this group in the senior high school general science was offered to 20 per cent of the students, physical science to 18 per cent, IME 10 per cent, earth science 7 per cent, and six other offerings for less than 5 per cent each. This indicates that 78 per cent of the ninth grade students were enrolled in science in the senior high school organization. The total ninth grade offerings in the middle school and senior high school organizations indicated the physical science offering as 24 per cent, general science as 15 per cent, IPS 13 per cent, and nine other offerings with less participation of the students. (See Table VI).

In the tenth grade 68 per cent of those eligible to enroll in science courses were registered in biology classes. The remainder, 5 per cent, were enrolled in chemistry, biologically related courses and other electives. (See Table VII). The total percentage of the tenth grade science enrollment was 73 per cent of those eligible.

In the eleventh grade 43 per cent elected chemistry and of the remainder of the students registered in science 15 per cent were enrolled in physical sciences, the biological sciences, and earth science, totaling 58 per cent enrolled in science in the eleventh grade. (See Table VII).

Physics was elected by 21 per cent of the students in the twelfth grade. The remainder of those enrolled elected a variety of science courses with the total registration of 30 per cent of the students. (See Table VII).

Since most senior high school science courses are elective, the students may select biology, chemistry, or physics in the tenth, eleventh, or twelfth grade, thus enrollment figures are influenced by individual selections and may vary from year to year. Only 20 per cent of the schools require a year of science study in grades ten through 12 and 10 per cent of these require biology. Requirements for graduation in Delaware are only one year of laboratory science. Since no other requirements by the state exist in science, as in other departments, the percentage of participation in science courses shows a sharp decrease in the eleventh and twelfth grades.

SERVICE LOADS

There were 197 full- and part-time science teachers in the high schools of Delaware the year the study was made. Those teaching full time accounted for 73 per cent of the total of science teachers. Of these teachers 63 taught biology full time and 10 others taught at least one class of biology. In the teaching of chemistry there were 23 full-time teachers and 11 others who taught one or more classes of chemistry. There were 10 full-time physics teachers with 14 more teaching only one or two classes of physics. There were 10 additional

TABLE VI

EXTENT OF PARTICIPATION AND PROGRAM OFFERINGS IN GRADE 9

	In Middle Schools		*In Senior High Schools*		*Total*	
	Enrollment 3013		*Enrollment 7461*		*Enrollment 10474*	
Program	*Number Enrolled*	*Percentage of Participation*	*Number Enrolled*	*Percentage of Particpation*	*Number Enrolled*	*Percentage of Participation*
General Science			1518	20%	1518	15%
Physical Science	1085	36%	1378	18%	2473	24%
IME			750	10%	750	7%
IPS	977	32%	346	5%	1323	13%
Earth Science			556	7%	556	5%
Chem-Phys			350	5%	350	3%
IIS			329	4%	329	3%
ESCP			199	3%	199	2%
Biology	164	5%	115	2%	279	3%
ISCS	124	4%	70	1%	194	2%
BSCS (Yellow)	287	10%			287	3%
Other			247	3%	247	2%

Total Percentage of Participation in All Science Programs In 9th Grade

In Middle Schools	In Senior High Schools	Total
78%	87%	82%

TABLE VII

EXTENT OF PARTICIPATION AND PROGRAM OFFERINGS IN GRADES 10, 11, 12

Grade	*Program*	*No. Enrolled In Grade*	*No. Enrolled In Program*	*Percentage of Participation In Each Program*	*Total Percentage of Participation In All Science Programs*
10	Biology		2962	30 %	
	BSCS - Blue		1729	17 %	
	BSCS - Green		395	4 %	
	BSCS - Yellow		1130	11 %	
	BSCS - SM		736	7 %	
	Earth Science	10013	100	1 %	73%
	Anatomy & Physiology		73	.8%	
	Ecology & Environment		31	.4%	
	Microbiology		33	.4%	
	Chemistry		61	.7%	
	Electives		68	.7%	
11	Chemistry		1921	22 %	
	CHEMS		1829	21 %	
	Chem-Phys Fused		563	7 %	
	Physical Science		75	.9%	
	Practical Science		75	.9%	
	Advanced Biology	8539	69	.8%	58%
	Earth Science		37	.5%	
	BSCS - Blue		25	.3%	
	IIS		24	.3%	

TABLE VII, cont.

Grade	*Program*	*No. Enrolled In Grade*	*No. Enrolled In Program*	*Percentage of Participation In Each Program*	*Total Percentage of Participation In All Science Programs*
	Applied Chemistry		13	.2%	
	PSSC		10	.1%	
	Electives		321	4 %	
12	Physics		876	11 %	
	PSSC		396	5 %	
	Chem-Phys. Fused		209	3 %	
	Physical Science		208	3 %	
	Chemistry		87	1 %	
	Biology	8034	84	1 %	30%
	Advanced Science		41	.5%	
	Senior Science		31	.3%	
	CHEMS		18	.2%	
	ECCP		12	.1%	
	Practical Science		12	.1%	

teachers who taught two sections of chemistry and two sections of physics thus teaching a full science schedule. Thirty-eight teachers were scheduled in the ninth grade most of whom were employed full time in science.

Most teachers taught five classes per day and met approximately 125 students each day. Since the chemistry and physics time allotments were usually six to seven periods per week the teachers in those subjects were teaching five periods per day but with a smaller total pupil enrollment.

The average class size reported was twenty-five pupils in 70 per cent of the schools and the range was from six to thirty pupils per class.

There were 303 sections of biology classes, 142 of chemistry, 64 of physics, and 103 of miscellaneous subjects scheduled for the year. Approximately 10 per cent of the schools reported team teaching of various types and these groups are not included in the previous figures of number of sections.

Very little ability grouping was reported as most of the courses were elective and chosen because of graduation requirements, especially in the eleventh and twelfth grades.

PROGRAM

In the senior high schools there was increased emphasis on laboratory activities especially in the schools where a national program had been adopted or adapted. Some schools had scheduled six periods per week for biology to increase student activity time and most schools scheduled six or seven periods per week for chemistry and physics. Flexible scheduling of various types was used in some schools. (See Tables VIII & IX).

TABLE VIII

PROGRAM OFFERINGS IN GRADE 9
MIDDLE AND SENIOR - HIGH - SCHOOL ORGANIZATIONS

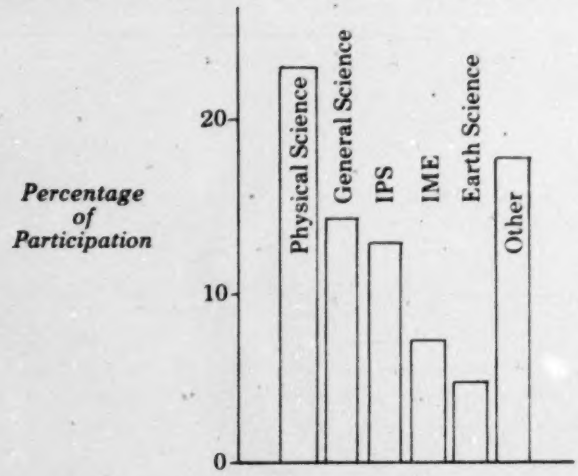
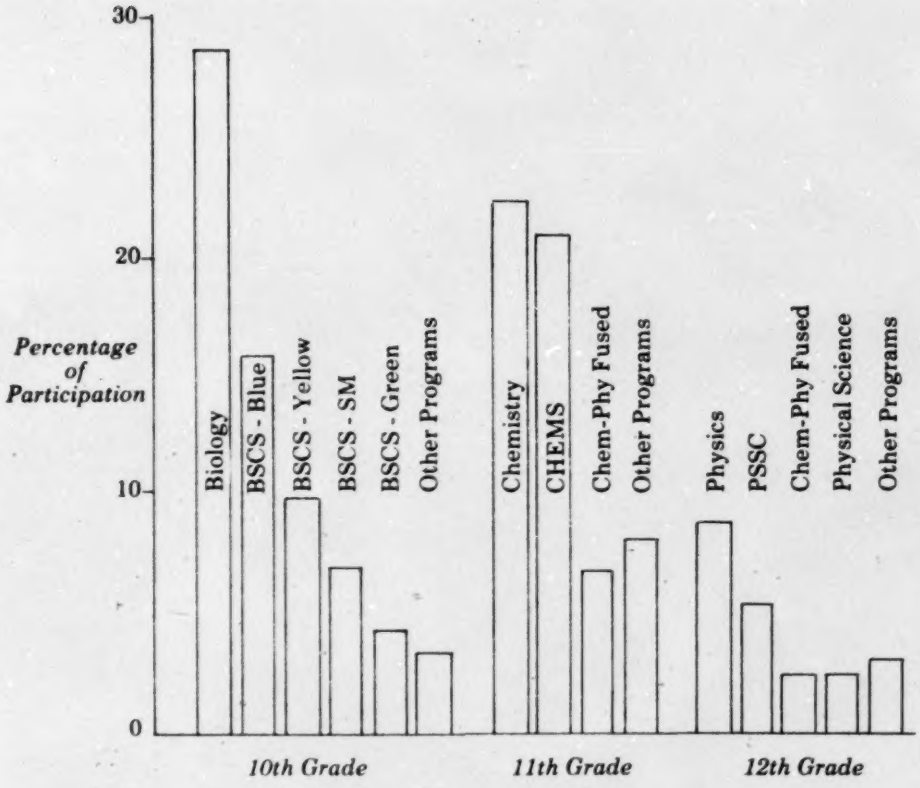


TABLE IX

PROGRAM OFFERINGS IN GRADES 10, 11, 12



Team teaching was used in some schools in which cases many teachers divided lecture-demonstration and laboratory responsibilities. Four schools employed aides to assist with this type of activity and with the care and maintenance of equipment.

Advanced science courses or science seminars were offered in 24 per cent of the senior high schools. Some schools offered short courses in various areas. Approximately 55 per cent of the schools offered courses, mostly to non-college preparatory students, in biology, chemistry, physical sciences or combinations of two or more areas.

In the biology offerings 39 per cent of the students were enrolled in the BSCS Program with enrollment in the blue version reported at 17 per cent, yellow at 11 per cent, green at 4 per cent, and the Special Materials at 7 per cent. Many teachers reported that the curriculum in use in individual schools was based on BSCS and had been modified to meet the needs of the students. This course of study accounted for 30 per cent of the enrollment in biology. Although only 69 per cent of the tenth grade students were enrolled in biological courses in the tenth year, others elected biology in the eleventh and twelfth grades. Thus the

total of students enrolled in biology during their years in the senior high school grades was 72 per cent of the total enrollment. (See Table X).

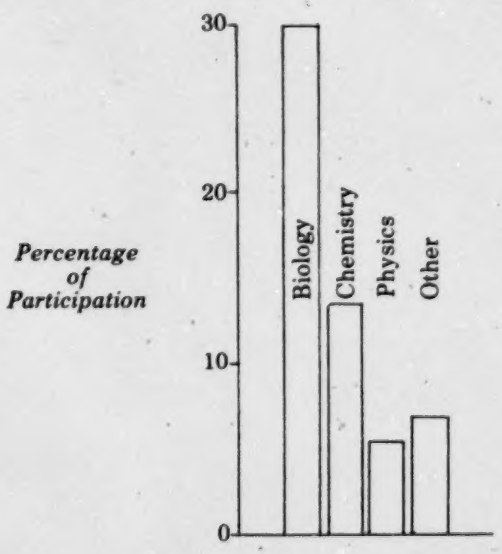
In the area of chemistry 21 per cent of the students were enrolled in CHEMS. However, teachers reported that the curriculum in use in the individual schools was based on CHEMS and CBA and had been modified to meet the needs of the students. Students enrolled in this type of course accounted for 22 per cent of the science enrollment in the eleventh grade.

In physics PSSC and HPP each account for 5 per cent of the science enrollment. As in the case of the other areas the largest physics enrollment was in physics courses modified to meet the needs of the students and was based on PSSC and HPP. One school offered the Engineering Concepts Curriculum Project (ECCP) program.

Teachers reported that in most cases the multi-text approach was used in science classes in the public senior high schools in Delaware.

TABLE X

PROGRAM OFFERINGS IN GRADES 10 - 12



Enrollment by Subject

Biology	7944	20%
Chemistry	3405	13%
Physics	1442	5%
Other	1936	7%

Total School Enrollment 26,586

Total Enrollment in Science 14,727 = 55% of Total Enrollment

Since science is almost entirely an elective subject, in any representative year the percentage of participation in science would be approximately 56 per cent of the total school population in grades ten through twelve.

FACILITIES

In most cases the senior high school science classes were taught in locations where science facilities were available. In 90 per cent of the buildings these facilities were new or remodeled and thus up-to-date. The combination classroom-laboratory was the most frequent installation. Storage areas were in most cases at least adequate. The various installations for science represented practically every plan possible and available. Anyone wishing to plan a science facility would be able to study every type of facility installed by visiting the science installations in the senior high schools in Delaware. (See Table XI).

Special facilities and equipment were reported in many schools as shown in the following tabulation.

Facility and percent of schools report:

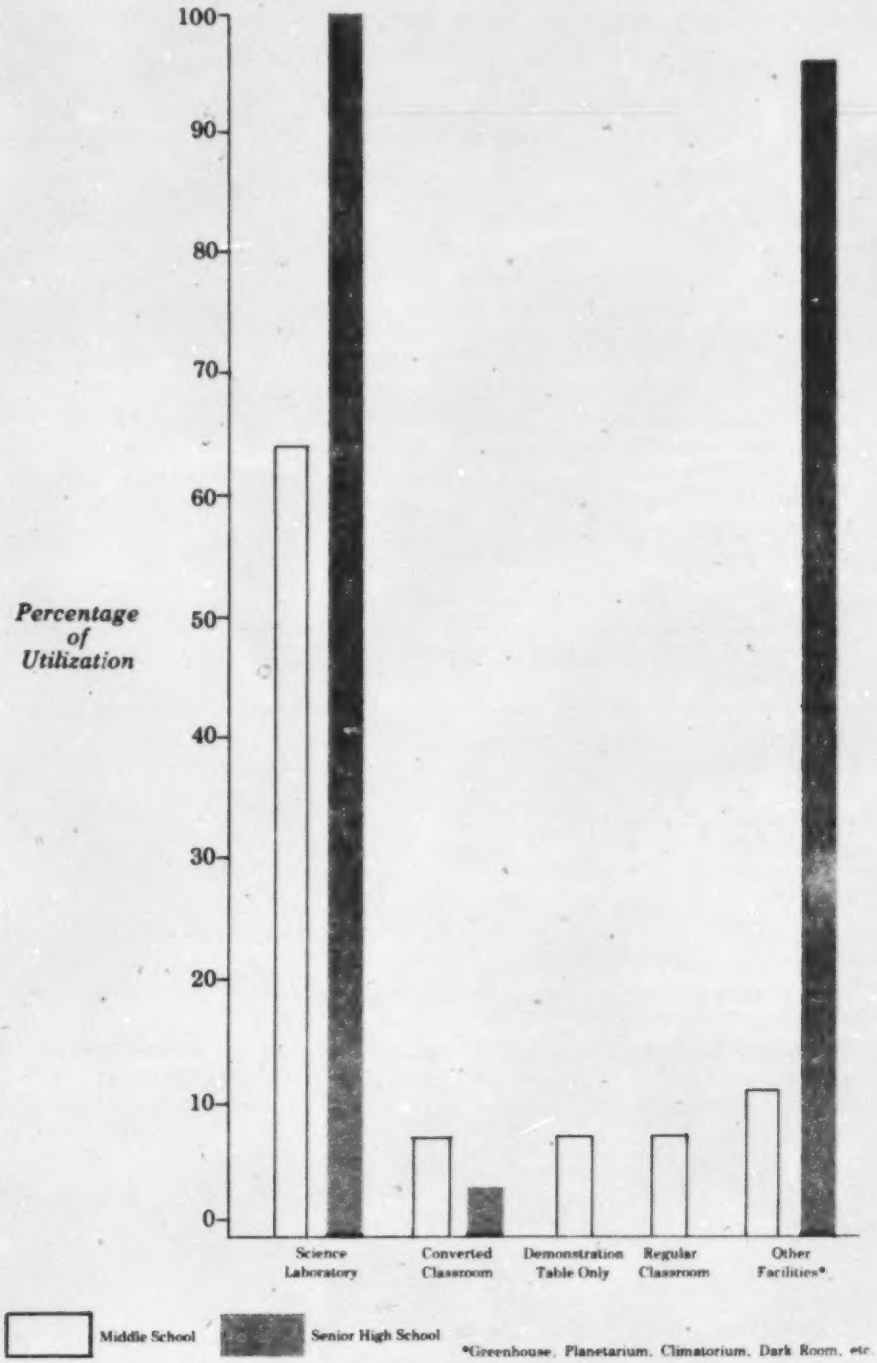
Plant and animal rooms	41%
Science offices	30%
Dark rooms	29%
Climatorium	29%
Project Rooms	24%
Greenhouses	24%
Planetarium	10%
Science library	10%

Other equipment reported to a lesser extent included telescopes, autoclaves, incubators, refrigerators, resource centers, closed circuit TV, computers, and climate controlled laboratories.

Safety equipment was adequate in most schools. In regard to the use of safety glasses by all pupils (Delaware State Law ¶8301 - 8304) approximately 80 per cent of the schools purchased glasses for student use. Methods for cleaning the glasses were practically non-existent. In the 20 per cent of the schools where the pupils bought their own glasses, the school furnished these to the pupils in hardship cases.

TABLE XI

COMPARISON OF THE TYPE OF FACILITY IN WHICH SECONDARY SCIENCE CLASSES ARE CONDUCTED



CONCLUSIONS

ELEMENTARY SCHOOL

- Science in the elementary school was a teacher dominated program with little participation on the part of the children.
- Only about 38 percent of the schools were departmentalized for science teaching at the upper elementary level.
- Equipment in the form of kits for special programs is available in schools where the nationally prepared program has been adopted.
- The time allotment for science teaching in the primary grades was weekly or at the discretion of the teacher in a large percentage of the schools but in the upper elementary grades science was taught daily in 42 per cent of the schools.
- Environmental education was taught and the children taken on field trips in most schools.
- Adoption of a national program did not necessarily mean increased science teaching.

MIDDLE SCHOOLS

- Course offerings in grade 5 were mostly life science, in grade 6 physical science, in grade 7 life science, in grade 8 earth science, and in grade 9 physical science.
- Lecture-demonstrations was the predominant method of science teaching.
- The service load was approximately 125 - 130 students with an average class size of 27 pupils.
- Sixty-five per cent of the science classes were taught in rooms equipped for the teaching of science in the middle school.

SENIOR HIGH SCHOOL

- Physical science was the predominant science taught in grade 9, biology in grade 10, chemistry in grade 11, and physics in grade 12.
- Due to the elective system in the senior high schools, there was a considerable drop in enrollments in grades 11 and 12.
- The service load was 120 - 125 students with an average class size of 25.
- Laboratory experiences for the student had increased at this level.
- Practically all science classes were taught with laboratory facilities available.

COMPARISONS BETWEEN 1969 AND 1974 SCIENCE AS TAUGHT IN DELAWARE SCHOOLS

ELEMENTARY SCHOOL

Although some of the basic problems which existed in 1969 still remain to be solved in the elementary schools, there are some interesting changes in science in these grades. The use of nature and environmental education as science topics, including field trips to nature trails, seems to have become very popular in a short period of time.

The unsolved basic problems seem to be a lack of sincere commitment to science in grades 1 - 4 in many schools. Mrs. Conaway felt that "random" was a good word to describe the teaching of science in these grades even though SAPA has been adopted by a sizable number of schools since 1969.

As in 1969, science textbooks, programs, curricula, and the like seem to be imposed upon teachers, rather than selected by teachers. This is frequently an administrative imposition which would explain the teachers' lack of commitment to complex programs such as SAPA.

The introduction of Del Mod Field Agent Programs in the upper elementary schools (and for a time in the primary grades) has had the effect of legitimizing science as a subject in some schools. In other words, it is taught regularly and it sometimes is taught in departmentalized situations.

Many teachers exposed to field agents, or involved in Del Mod workshops, have made use of resource centers in Georgetown or Newark which were not in existence in 1969. Conversely, science fairs, popular in 1969, are virtually non-existent in 1974. Educational television is also a thing of the past. The use of kits seems to be much more widespread, but **adoption of a national program did not necessarily mean increased science teaching.**

MIDDLE SCHOOLS

As in 1969, it was not easy to classify schools as "middle schools", but, for purposes of this report grades 5 - 9 constituted the middle school study.

Basically, the science program in the middle school grades has not changed. Class sizes have diminished and there are better equipped labs, but the lecture-demonstration method of teachng still prevails.

The considerable exposure to Del Mod field agents among middle school science teachers has had its best effect in the areas of environmental/nature education and in multi-text teaching methodology.

At this level teachers seem to have much greater control over what is taught and which materials, texts, etc., they will use. The total science program in middle schools seems to be undergoing a great amount of revision and growth.

The main problem areas of 1969 were proper use of facilities such as labs, and the amounts of money available for expenditures. The former has improved while the latter has remained static. Teachers have to be "ingenious" to make small budgets and inadequate supplies go a long way.

Evaluation was studied by Purnell in 1969, but not by Cornell in 1974. Nonetheless, it is safe to say that evaluation of student progress is still in the hands of the individual teacher in grades five through nine.

HIGH SCHOOLS

The most startling comparision here involves student enrollment statistics. Since 1969, grade 10 science participation has dropped from 85% of the student population to 73%. In Grade 11, the figures reverse with a jump from 47% in 1969 to 58% in 1974. In grade 12, the figures were 36% in 1969 and 30% in 1974. Physics is still a subject attempted by only one student in ten.

Cornell feels that lab activities have increased, and that the actual time spent in science classes has been expanded since 1969. Facilities are more than adequate and safety is a strong feature.

Del Mod has not spent much time or money in the high schools, and no field agents are assigned at this level. It is not remarkable that the least amount of change has occured at this level of schooling. Enrollment drops in science are partially a result of changes in student requirements for graduation, and partially due to a change in public acceptance of science.

It should also be stressed that high school science required less change than did elementary or middle school science. Levels of science teaching competence are higher in the high schools, and science enjoys a much greater status in the curriculum.

EVALUATION

Science testing is done by the Research Division of the State Department of Public Instruction in grades 4 and 8. Recent test results indicate a drop in scores on science tests. This is due in part to a change of curriculum in the grades, and in part because the test instrument has been changed and, therfore, the children have been asked more discriminating questions.

All other testing is the responsibility of the schools. Teacher constructed tests are the most prevalent form of evaluating student progress and of assigning grades to students. Thus, the situation concerning evaluation has not changed since 1969.

Obviously, testing is the weakest area in Delaware's schools in 1974, but no solution to this problem is suggested. Teacher constructed tests may be

amateurish or even biased, but they are still better gauges of student performance than nationally normed achievement tests. This becomes evident when the Delaware Educational Assessment Program science tests for grades 4 and 8 tested student retention of science facts after many of Delaware's schools had shifted to the adoption of science programs which stress understanding of science processes. The distinction here is the difference between knowing how to identify a tool as opposed to knowing how to use a tool. The latter would seem to be preferable, but it was not tested, nor are there any reliable tests available to test process-oriented science programs which can be administered to a large audience.

The Instructional Services Branch of the Department of Public Instruction currently has established a system of on-site evaluation of the Delaware Schools. The program is carried out at the elementary, middle/junior high and senior high school levels. The information obtained from these evaluation programs will serve as the basis for future status reports.

In accordance with the Delaware Code, the State Board of Education has approved "Equinox" for use in the Delaware Schools. This guide will provide the evaluative standard for all K-12 natural science programs and the basis for the state-wide testing program.